

## Exhibit 6

# **FDNY FIREFIGHTER TEST DEVELOPMENT AND VALIDATION REPORT**

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**Submitted By:**

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## CONTENTS

EXECUTIVE SUMMARY.....	1
CHAPTER 1: INTRODUCTION AND OVERVIEW OF THE PROJECT .....	14
Introduction.....	14
Problem and Setting.....	14
Project Scope .....	15
User(s), Locations(s) and Date(s) of Study.....	15
CHAPTER 2: FDNY FIREFIGHTER JOB ANALYSIS .....	16
Introduction.....	16
Job Data Collection: Observation, Focus Group and Surveys .....	16
Survey Sampling Plan and Onsite Administration .....	19
Analysis of Core Firefighter Tasks and Abilities/Characteristics .....	19
Linkage of Abilities/Characteristics and Tasks.....	23
Analysis of Reading Demands and Learning Process.....	28
Development of Job Analysis-Based Performance Measures .....	30
Summary.....	34
CHAPTER 3: DEVELOPMENT OF A NEW FIREFIGHTER TEST.....	35
Introduction.....	35
Test Design Founded on Job Analysis.....	35
Development of Multimedia Test Items and Materials .....	37
Testing Expert Review.....	38
Description of the Firefighter CBT.....	39
Summary.....	40
CHAPTER 4: DOCUMENTATION OF VALIDITY EVIDENCE .....	41
Introduction.....	41
Content Validity Study .....	42
Criterion-Related Validity and Construct Validity Study .....	47
Investigation of Fairness.....	58
Summary.....	60
CHAPTER 5: DEVELOPMENT OF ALTERNATE TEST FORMS .....	61
Introduction.....	61
Alternate Test Forms Development.....	61
Equivalency Study.....	62
Summary.....	67

<b>CHAPTER 6: SCORING AND USE OF THE FIREFIGHTER TEST .....</b>	<b>68</b>
<b>Introduction .....</b>	<b>68</b>
<b>Scoring Procedure and Rationale .....</b>	<b>68</b>
<b>Tutorial for the CBT .....</b>	<b>72</b>
<b>Administration of the CBT .....</b>	<b>72</b>
<b>Post-Administration Analysis .....</b>	<b>72</b>
<b>Candidate Final CBT Scores .....</b>	<b>74</b>
<b>Use of CBT Scores to Select Candidates .....</b>	<b>76</b>
<b>Projected Selection Rates over the Life of the Eligible Lists .....</b>	<b>78</b>
<b>Adverse Impact Analyses .....</b>	<b>79</b>
<b>Summary .....</b>	<b>82</b>
<b>REFERENCES .....</b>	<b>83</b>
<b>APPENDICES .....</b>	<b>84</b>
A. Job Analysis Survey Quality Check Questions	
B. Job Analysis Survey Rating Scales	
C. Job Analysis Surveys	
D. Job Analysis Survey Sample Description	
E. Survey Data Quality Control Rules	
F. Job Analysis Surveys Retained	
G. Job Task Survey Summary Statistics	
H. Ability/Characteristic Survey Summary Statistics	
I. Core Tasks and Abilities/Characteristics	
J. Linkage Rating Survey	
K. Linkage Rating Results	
L. Task Category Importance Rating Instructions	
M. Readability Analysis: Documents and Results	
N. FDNY Learning Process Interview Forms	
O. Job Performance Rating Booklet	
P. Content Validation Rating Form	
Q. Memo to Content Validation Session Participants	
R. Job Performance Rating Data Quality Control Checks	
S. Job Performance Ratings: Descriptive Statistics	
T. Principal Components Analysis of Job Performance Ratings	
U. Descriptive Statistics for Probationary Training Academy Scores	
V. Firefighter Test Data Quality Control Checks	
W. Psychometric Properties of Experimental CBT Form A	
X. Validity Results for Experimental CBT (Form A)	
Y. Construct Validity Tables	
Z. Quality Control Criteria for Equivalency Study Test Data	
AA. Derivation of CBT Scoring Weights	
AB. Derivation of Minimum Passing Score on the CBT	
AC. CBT Scale Score Formulas	
AD. Summary of CBT Scale Score Conversion for Candidates	
AE. Item Analysis of Candidate Response Data	
AF. Equivalence of Alternate CBT Form Cognitive Portions	

## TABLES

Table 1. Characteristics of the Job Analysis Survey Sample .....	21
Table 2. Characteristics of Linkage Participant Sample .....	23
Table 3. Firefighter Core Abilities and Characteristics .....	25
Table 4. Firefighter Task Category Importance Rating Results .....	27
Table 5. Description of Participants in the Learning Process Interviews .....	29
Table 6. Job Performance Rating Dimensions .....	31
Table 7. Overview of the Firefighter CBT .....	39
Table 8. Characteristics of the Content Validation Session Participant Sample .....	43
Table 9. Content Validation Results .....	46
Table 10. Validation Study Sampling Plan .....	48
Table 11. Characteristics of Firefighter Job Performance Sample .....	49
Table 12. Descriptive Statistics for Job Performance Rating Composites .....	51
Table 13. Correlations between Probationary Training Academy Scores and Job Performance Ratings .....	51
Table 14. Characteristics of Firefighters Tested in Criterion-related Validation Study .....	53
Table 15. Characteristics of Firefighters in the Criterion-related Validation Sample .....	55
Table 16. Criterion-related Validity Evidence for the CBT (Form A) .....	57
Table 17. CBT Fairness Analysis Results .....	59
Table 18. Characteristics of the Equivalency Study Sample .....	65
Table 19. CBT Cognitive Item Analysis Summary .....	66
Table 20. Equivalence of Alternate CBT Forms .....	66
Table 21. Bonus Point Credits .....	71
Table 22. Candidate Passing Rates on the CBT .....	74
Table 23. Distribution of Final CBT Scores for Promotional Candidates (Exam 2500) .....	74
Table 24. Distribution of Final CBT Scores for Open Competitive Pool of Candidates (Exam 2000) .....	75
Table 25. Projected Annual Candidate Selection Rates .....	78
Table 26. Adverse Impact Analysis .....	80



SDs below the mean SD); this criterion resulted in the removal of one rater who completed Form A, and one rater who completed Form B.

### *Reliability of Linkage Ratings*

The reliability of the linkage ratings was assessed by computing the ICC in a similar manner to the analysis of job analysis survey ratings. The ICC was computed for survey Form A and Form B, after adjusting the data to account for missing ratings. The reliability of the average of all raters was high, with ICC values of .82 and .91 for Forms A and B, respectively.

### *Linkage Rating Results*

An ability/characteristic was considered to be “linked” to a Task Category if it was rated as essential for successful performance of the Task Category by a strong majority of raters (at least 66.7%). An ability/characteristic was required to be linked to at least one Task Category to be included in the final list of core abilities/characteristics considered for inclusion in the design of the new test. A total of 49 core ability/characteristics were identified as essential for the performance of tasks in at least one Task Category. The linkage rating results are reported in Appendix K; cells in the table with shading indicate that the percentage of the sample endorsing an item as essential was at least 66.7%.

The resulting final list of 49 core abilities/characteristics is reported in Table 3 (original survey ID numbers are shown for each item). These abilities and characteristics represent a range of domains, including cognitive ability, physical ability, and other noncognitive characteristics.

Table 3. Firefighter Core Abilities and Characteristics

<b>Cognitive Abilities</b>
001-Ability to read and interpret short messages written in English (for example, notes, log entries, teleprinter tickets).
002-Ability to read routine documents written in English (for example, bulletins, articles, notices, announcements) to keep apprised of current job-related information.
003-Ability to read and interpret technical materials written in English (for example, instructional manuals, operating manuals, and other official FDNY documents) to learn new information and/or update job knowledge.
005-Ability to write brief notes/statements in English (for example, fill in forms, log entries, take messages) legibly, completely, and accurately.
007-Ability to listen to, and understand information on how to perform a task or series of tasks from a trainer or others (for example, instructions from a commanding officer, training information on specific steps to follow in different situations).
008-Ability to understand information presented orally in English, both in person (for example, in a training session) and from a variety of communications devices (for example, radio, phone, intercom).
009-Ability to listen to and understand people in emergency situations (for example, people who are upset, frightened, confused).
010-Ability to state ideas clearly and concisely when speaking in English (for example, giving instructions, explaining procedures, providing technical information).
016-Ability to quickly and accurately compare letters, numbers, information and objects (for example, addresses,

names, radio codes) to determine if they are the same or different.

017-Ability to concentrate on the work to be performed in spite of distractions, keeping aware of one's surroundings (for example, during a highway accident).<sup>13</sup>

018-Ability to remain attentive while performing routine or repetitive tasks (for example, taking up hose line).<sup>13</sup>

021-Ability to observe another person performing/demonstrating an activity to learn how to perform the activity.

051-Ability to learn firefighting procedures and techniques.

052-Ability to learn job-related rules and regulations.

065-Ability to perform arithmetic computations (for example, add, subtract, multiply, divide) to solve work problems (for example, number of hose lengths needed to reach a fire).

072-Ability to analyze mistakes to avoid repeating them (for example, to review fire scene errors after the incident has concluded).

088-Ability to recall information learned in training even when it is used infrequently.

089-Ability to recall information regarding specific events and activities (for example, tactics used in prior fire scenes).

#### **Physical Abilities**

022-Ability to use muscular force to lift, push, pull, drag, carry, objects, materials, equipment and/or people.

023-Ability to use muscular force to physically control victims as needed (for example, during roof rope rescue).

024-Ability to exert maximum muscular force to use equipment or perform other activities (for example, when using hook, axe, carrying a hose).

025-Ability to exert muscular force quickly to initiate action (for example, to start a chain saw, force a door).

026-Ability to maintain a high level of physical effort (for example, advancing hose line) under difficult environmental conditions (for example, heat, smoke, darkness).

027-Ability to bend, twist, stretch, and reach with the body, arms, and/or legs (for example, on a fire escape, entering a window).

031-Ability to coordinate the rapid movement of arms, legs, and/or the torso while the entire body is in motion (for example, climbing a ladder).

#### **Noncognitive Characteristics**

036-Willingness to adapt to and become a member of an established team.

038-Willingness to request assistance from a co-worker or supervisor when necessary to complete an assignment.

039-Willingness to offer information and/or assistance and information to co-workers when it appears necessary or when it would facilitate task accomplishment.

041-Willingness to do one's share of the work including performance of undesirable tasks.

043-Willingness to show respect toward those with more experience or in a position of authority.

045-Willingness to accept responsibility for one's own actions.

046-Willingness to comply with assignments, commitments, requirements, and/or instructions regardless of personal feelings about a situation.

047-Willingness to maintain appropriate attention to detail and persist in work activities in order to complete work in a safe, effective and timely manner.

048-Willingness to work without direct supervision.

049-Willingness to maintain high standards of ethical conduct for self and others.

050-Willingness to devote time and effort to all aspects of the job, including those that are routine in nature.

094-Willingness to risk harm to self to attempt to ensure the safety of others.

095-Willingness to obey orders promptly.

096-Willingness to accept and follow all rules and regulations.

097-Willingness to follow all safety rules, use all safety equipment, and avoid unnecessary risk.

102-Willingness to seek training or other assistance to ensure needed improvements in job performance are made.

103-Willingness to master work activities and continue learning throughout career.

<sup>13</sup> At a subsequent step in the project, it was determined that abilities related to (017) concentration, and (018) attention would be better addressed in the non-cognitive domain.

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- 104-Willingness to accept constructive criticism without becoming offended.
- 
- 105-Willingness to ask questions even when to do so indicates lack of knowledge or understanding.
- 
- 111-Ability to convey a professional and trustworthy image; to create a positive impression.
- 
- 112-Willingness to maintain appearance within department standards.
- 
- 115-Ability to maintain control of personal reactions and impulses while taking charge of or handling a disagreeable or dangerous situation.
- 
- 122-Ability to interact effectively with other people.
- 
- 125-Ability to interact with people of both sexes and of different races/ethnicities, cultural or religious beliefs/practices, sexual orientation, and/or socioeconomic status in a fair and respectful manner.
- 

### *Task Category Importance Ratings*

In the final section of the Linkage survey, participants were asked to review the 17 Task Categories and the core tasks listed within each category. Then, they were instructed to distribute 100 points across the Task Categories, based on the relative importance of each category to Firefighter job performance. Appendix L shows the specific instructions. These ratings were used later in developing test specifications.

Table 4 shows the resulting means of the points allocated to each Task Category by the SMEs. The results indicate that Engine Company Operations, Victim Removal, and Search received the highest point allocations (were considered more important) relative to other Task Categories. Conversely, Clean Up/Pick Up, Inspection of Buildings/Hydrants/Alarm Boxes, and Overhaul were identified as the least important Task Categories.

Table 4. Firefighter Task Category Importance Rating Results

Task Category	Mean Relative Importance (%)	SD
1. Station & Equipment Maintenance/Chores	5.29	3.02
2. Initial Response to Incident/Driving	5.47	2.17
3. Size-Up & Initial Actions	7.29	4.78
4. Ladder Operation	7.34	6.52
5. Climbing & Portable Ladder Activities	6.14	2.87
6. Building Entry	7.15	1.97
7. Search	7.49	2.33
8. Victim Removal	7.60	2.90
9. Ventilation	6.08	2.77
10. Engine Company Operations	10.10	5.08
11. Overhaul	3.35	1.55
12. Clean Up/Pick Up	2.44	1.71
13. Inspection of Buildings/Hydrants/Alarm Boxes	2.76	1.76
14. Rescue/Extrication	6.92	2.72
15. Providing Medical Assistance	4.95	2.56
16. Training	6.13	3.16
17. House Watch Duties	3.51	1.94
<i>N=35 raters</i>		

*Note: ratings were rescaled to total 100 for raters whose ratings did not total exactly 100.*



## CHAPTER 3: DEVELOPMENT OF A NEW FIREFIGHTER TEST

### Introduction<sup>17</sup>

This chapter summarizes the design and development of a new test for entry-level Firefighter selection at the FDNY. The test was designed by PSI specifically to measure cognitive abilities and other characteristics identified in the FDNY Firefighter job analysis as essential for successful performance of Firefighter job tasks, and required prior to entry into the probationary Firefighter Academy. Several equivalent alternate forms of the test were developed to maintain the security of the test by limiting and scrambling the exposure of the test content during administration to candidates.

The new test incorporated advanced technology features to provide a realistic, objective, and secure assessment. A computer-based test (CBT) system was utilized to deliver and score the test in a standardized and reliable manner, with enhanced security features such as item randomization. Many of the items incorporated multimedia (audio/video) formats to simulate the manner in which Firefighters learn and apply new information; traditional multiple-choice written questions were also included.

The following sections describe the test design and development procedure, which took place between February and November 2011. A summary of the final version of the Firefighter CBT is also presented.

The test development methodology was designed to be consistent with professional standards and principles (AERA, APA, NCME, 1999, *Standards for Educational and Psychological Testing*; SIOP, 2003, *Principles for the Validation and Use of Personnel Selection Procedures*; EEOC et al, 1978, *Uniform Guidelines on Employee Selection Procedures*).

### Test Design Founded on Job Analysis

Design specifications for the new test were developed on the basis of the job analysis results. Attention also was given to the broader psychometric literature on the measurement of abilities and characteristics, along with review of other selection tools used in screening Firefighter candidates. This work resulted in producing a test specification that was used to define the content areas that would be measured on the new test and the development of test items.

#### *Assessment Dimensions*

The first step in designing the test was to identify assessment dimensions to serve as the content areas for which test questions would be developed. Assessment dimensions were developed directly from the job analysis results by grouping together the “core” abilities and characteristics identified in the FDNY Firefighter job analysis. The assessment dimensions were developed by PSI, with assistance from DOJ and Vulcan Society testing experts in meetings conducted in February and March 2011. As a result of these meetings and subsequent test development and review sessions, the abilities and characteristics identified in the job analysis were grouped into

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<sup>17</sup> Uniform Guidelines Section 14 C.(3); 15 B.(7); C.(4); D.(6).

ten major content areas. The ten areas also were linked to literature-based constructs falling within cognitive<sup>18,19</sup> and noncognitive<sup>20</sup> domains. The final assessment dimensions included:

Cognitive Abilities:

- Reading Comprehension
- Ability to Learn and Apply Information
- Basic Arithmetic
- Listening Comprehension
- Reasoning

Noncognitive Characteristics:

- Conscientiousness
- Agreeableness
- Emotional Stability
- Interpersonal Competence
- Honesty/Socialization

The new test was not designed to address physical abilities documented during the job analysis process. These requirements of the FDNY Firefighter job will be assessed by the City in a separate testing instrument.<sup>21</sup>

*Test Specifications*

Once the assessment dimensions were identified, specifications for test item development were developed by PSI, in consultation with the DOJ and Vulcan Society testing experts. In doing so, consideration was given to utilizing test formats and item types that were:

- Realistic and similar to how individuals learn and perform the job, incorporating multiple modes of information (lecture, demonstration, observation, reading);
- Multimedia-based and not overly reliant upon reading comprehension, particularly for assessment dimensions where reading was not the specifically targeted ability;
- Comparable in reading level to documents used by FDNY Firefighters (i.e., for Reading Comprehension test passages);
- Reliable, objective, practical and amenable to automated delivery and scoring with a candidate pool numbering in the tens of thousands; and
- Resistant to cheating and harvesting (stealing) of content.

The resulting test specifications for the cognitive assessment dimensions took the form of a video-based simulation, depicting an entry-level Firefighter's initial assignment to the FDNY

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<sup>18</sup> Ackerman, P.L., & Heggestad, E.D.(1997). *Intelligence, Personality, and Interests: Evidence for Overlapping Traits*. Psychological Bulletin. Vol. 121, No. 2, 219-245.

<sup>19</sup> Fleishman, E.A., Quaintance, M.K., & Broedling, L.A. (1984). *Taxonomies of Human Performance: The description of human tasks*. Orlando, FL: Academic Press, Inc.

<sup>20</sup> Hough, L. M., & Ones, D. S. (2001). The structure, measurement, validity, and use of personality variables in industrial, work, and organizational psychology. In N. R. Anderson, D . S. Ones, H . K. Sinangil, & C. Viswesvaran (Eds.), *Handbook of Industrial, Work & Organizational Psychology: Vol. I* (pp.233-277). London and New York: Sage.

<sup>21</sup> The Candidate Physical Ability Test (CPAT) is presently used by the City to assess Firefighter candidate physical capabilities.

training academy and attendance at training sessions, supplemented by test items simulating excerpts from an operations manual focusing on reading material related to the simulated lesson. Specifications representing the noncognitive assessment dimensions included traditional multiple-choice questions of several types (biographical, work attitude, and workplace personality); 14 noncognitive facets were identified to represent the noncognitive assessment dimensions. Computer-based test (CBT) delivery of test questions was specified to support controlled delivery of multimedia question types that incorporate video and graphic images. CBT also enables secure delivery of alternate test forms and scrambling of test questions, which helps to foil cheating and content harvesting efforts.

### **Development of Multimedia Test Items and Materials**

On the basis of the test specifications and other information (e.g., samples of FDNY job and training materials) PSI drafted scenario scripts and test items referencing fictitious equipment. A training simulation was created to provide a unified theme within which to address the cognitive assessment dimensions. Noncognitive items were written using established formats and question themes to assess literature-based constructs linked to the various core Firefighter characteristics within this domain.

#### *Training Simulation Design*

A training simulation was designed by PSI to assess the cognitive assessment dimensions by creating a fictional scenario with novel content pertaining to fictitious equipment and procedures. Care was taken to ensure that there would be no prior knowledge of equipment, procedures or operating principles needed in order to learn and apply the information from the training simulation. In creating content for the scenario, the FDNY Firefighter Probationary Academy Training Manual was reviewed to identify examples of equipment, materials, technical information, and operating procedures and guidelines that could be modeled in a novel way. To this end, scenarios were created for two training lessons: (1) Operation, technical properties and use of a fictitious piece of equipment, and (2) Technical properties, detection, and communication procedures for a fictitious hazardous chemical.

Once two scenarios were created, scripts were drafted for actors to play an instructor and student for purposes of filming an enactment of the scenarios and serve as stimulus materials for the test. The fictitious equipment and various props used in the scenarios were also constructed by PSI staff. Test items were written and reviewed by Ph.D. and Master's level staff with degrees in Industrial Psychology and extensive experience in test development. Test questions were written for each of the assessment dimensions, incorporating the range of item types included in the test specifications. These included multiple-choice single answer; multiple-choice multiple-answer; graphical item stems; graphical item response options; hot spot (click on a picture) items; and drag-and-drop items that required respondents to click-on and move things to indicate the appropriate order. Reading comprehension passages were written to simulate an operations manual for the fictional equipment and adjustments to sentence length and use of polysyllable words were made to ensure the reading level was in the range of FDNY Firefighter documents (reading level ranged from grade 9.9 to 11.5 for the reading comprehension passages included in the final CBT Form A). The simulated lectures and demonstration were filmed on June 1, 2011, and post-production of the media files took place over the following two weeks. A Training

Guide was developed for use by examinees during the CBT to briefly study before each video lesson, to take notes during the video lesson, and to refer to in answering the test questions.

The draft scenario scripts, test items and videos were posted on a secure web server to provide the DOJ, Vulcan Society and Special Master testing experts an opportunity to review and comment on the materials prior to a formal review session in June 2011.

An overview of the final version of the Training Simulation Test-Form A is shown in the last section of this chapter.

### *Noncognitive Items*

Noncognitive items were developed using a structured process that involved the following steps.

- PSI conducted a literature review to identify promising item types and formats for use. Multiple item types were identified and used (e.g., subtle vs. contextualized items; biographical vs. self-description).
- PSI prepared guidelines for item writers, describing effective approaches for writing attitudinal, biographical, and self-description items.
- Item writers (Industrial/Organizational Psychologists) drafted items covering the targeted assessment dimensions and associated constructs.
- PSI project team members selected items from the resulting item pool that represented a balanced array of item types, assessment dimension coverage, and related noncognitive construct coverage.
- DOJ and Vulcan Society testing consultants reviewed and provided feedback for revision of the selected draft items.

Fourteen (14) noncognitive scales were developed to represent facets of the five noncognitive assessment dimensions. An overview of the noncognitive portion of the final validated test (Noncognitive Test Form A) is shown in the last section of this chapter.

PSI staff authored the test items, media files and examinee instructions into PSI's proprietary CBT system. The content was posted and subjected to PSI quality assurance reviews in preparation for administration of a pretest of the new materials in July 2011.

### **Testing Expert Review**

A formal review of the draft videos and test items was conducted with testing experts representing DCAS/PSI, DOJ, the Vulcan Society and the Special Master in Chicago, on June 21-22, 2011. The objective of the session was for the experts to review and confirm appropriateness of test instructions, scripts and video test prompts and to identify and suggest any needed edits by consensus. PSI prepared an "item book" for each of the session participants, which included a complete copy of all test questions and related exhibits. PSI presented the videos to the participants using a projector and screen.

The experts recommended edits and enhancements, such as adding pauses and graphical cues in the videos; modifying and clarifying some of the instructions; clarifying certain images and



exhibits associated with test questions; and miscellaneous edits to certain test questions. In addition, the experts agreed that additional biographical questions should be written.

PSI executed the recommended modifications and made additional refinements to the videos, instructions and questions. The videos were edited and narration for the test instructions was re-recorded. The updated items and videos were posted to a secure web site to provide the testing experts an opportunity to review the revised content.

### Description of the Firefighter CBT

An experimental version of the Firefighter CBT was assembled for pilot testing and use in validation phases of the project. This experimental version contained extra test items to allow for the subsequent selection of test item sets that best predict job performance, while minimizing subgroup differences.

The final version of the Firefighter CBT is summarized in Table 7. The information presented reflects the final validated version (Form A) of the test. The cognitive portion of the test contained 57 items; the noncognitive portion contained 65 items. The total examination time was projected at four hours.

Table 7. Overview of the Firefighter CBT

Cognitive (57 items)	Protocol	Assessment Dimension
<b>Video Lesson (26 items)</b> Part 1 Lecture – Equipment Operation and Use  Part 2 – Narrated slide show on Equipment safety  Part 3 – Student-Instructor Questions & Answers	<i>Examinee is provided a printed outline of the training material to review; untimed.</i>  <i>Then examinee watches video lesson, taking notes on the training outline; 2 replays allowed; then answers several questions.</i>  Examinee watches narrated slide show, taking notes on the training outline; then answers several questions.  Examinee watches three, 1 and 1/2 minute video clips, taking notes on the training outline; 2 replays allowed; answers several questions.	<ul style="list-style-type: none"> <li>• Ability to learn and apply information</li> <li>• Listening comprehension</li> <li>• Reasoning</li> </ul>
<b>Operations Manual (31 items)</b>	Examinee reads a 1-page excerpt from an operations manual for the equipment, shown on the right side of the computer screen; then answers several questions regarding the passage; a total of 3 different passages are presented; some content overlaps with the lecture.	<ul style="list-style-type: none"> <li>• Reading Comprehension</li> <li>• Basic Arithmetic</li> <li>• Reasoning</li> </ul>
Noncognitive (65 items)	Protocol	Assessment Dimension
<b>Background Questions</b> - Dependability - Activity - Agreeableness - Even Tempered - Low Anxiety - Self Esteem	Examinee is presented a series of multiple-choice questions (biographical, behavioral description, endorsement)	<ul style="list-style-type: none"> <li>• Conscientiousness</li> <li>• Agreeableness</li> <li>• Emotional Stability</li> <li>• Interpersonal Competence</li> <li>• Honesty/Socialization</li> </ul>